

WHAT IS CLAIMED IS:

- 1           1.     A method for forming self-pinned abutted junction heads, comprising:  
2           forming a free layer;  
3           forming first hard bias layers abutting the free layer; and  
4           forming second hard bias layers over the first hard bias layers discontinuous  
5           from the free layer, the second hard bias layers being anti-parallel to the first hard bias  
6           layers, the first and second hard bias layers providing a net longitudinal bias on the free  
7           layer.
- 1           2.     The method of claim 1, wherein the forming the first and second hard bias  
2           layers further comprises forming the first hard bias layers with a thickness substantially  
3           equal to a thickness of the second hard bias layers.
- 1           3.     The method of claim 1, wherein the forming the first and second hard bias  
2           layers further comprises forming the first hard bias layers with a thickness greater than a  
3           thickness of the second hard bias layers.
- 1           4.     The method of claim 1 further comprising forming an interlayer separating  
2           the first and second hard bias layers.

1           5.       The method of claim 1 further comprising forming a self-pinned layer, the  
2 self-pinned layer having a first end, a second end and central portion, wherein the central  
3 portion is aligned with the free layer and the first hard bias layers are formed over the  
4 first and second ends of the self-pinned layer.

1           6.       The method of claim 5 further comprising forming a spacer layer over the  
2 self-pinned layer and forming a first and second seed layer between the first and second  
3 hard bias layer and the spacer layer.

1           7.       The method of claim 6 further comprising forming amorphous layers  
2 between the spacer and the first and second seed layers, the amorphous layer stopping  
3 epitaxial growth between the self-pinned layer and the first and second hard bias layers.

1           8.       The method of claim 5 further comprising forming amorphous layers  
2 between the self-pinned layer and the first and second hard bias layers for stopping  
3 epitaxial growth between the self-pinned layer and the first and second hard bias layers.

1           9.       The method of claim 1 further comprising forming first and second leads  
2 over the first and second hard bias layers.

1           10.      The method of claim 1, wherein the forming the free layer further  
2 comprises forming the free layer with a length selected for a desired track width.

1           11.     A self-pinned abutted junction magnetic read sensor, comprising:  
2           a free layer for sensing magnetic fluxuations;  
3           first hard bias layers abutting the free layer; and  
4           second hard bias layers, formed over the first hard bias layers discontinuous  
5           from the free layer, the second hard bias layers being anti-parallel to the first hard bias  
6           layers, the first and second hard bias layers providing a net longitudinal bias on the free  
7           layer.

1           12.     The sensor of claim 11, wherein the first hard bias layers is formed with a  
2           thickness substantially equal to a thickness of the second hard bias layers.

1           13.     The sensor of claim 11, wherein the first hard bias layers is formed with a  
2           thickness greater than a thickness of the second hard bias layers.

1           14.     The sensor of claim 11 further comprising interlayers disposed between  
2           the first and second hard bias layers.

1           15.     The sensor of claim 11 further comprising a self-pinned layer, the self-  
2           pinned layer having a first end, a second end and central portion, wherein the central  
3           portion is aligned with the free layer and the first hard bias layers are formed over the  
4           first and second ends of the self-pinned layer.

1           16.    The sensor of claim 15 further comprising a spacer layer formed over the  
2 self-pinned layer and a first and second seed layer formed between the first and second  
3 hard bias layer and the spacer layer.

1           17.    The sensor of claim 16 further comprising amorphous layers formed  
2 between the spacer and the first and second seed layers, the amorphous layer stopping  
3 epitaxial growth between the self-pinned layer and the first and second hard bias layers.

1           18.    The sensor of claim 15 further comprising amorphous layers formed  
2 between the self-pinned layer and the first and second hard bias layers for stopping  
3 epitaxial growth between the self-pinned layer and the first and second hard bias layers.

1           19.    The sensor of claim 11 further comprising first and second leads formed  
2 over the first and second hard bias layers.

1           20.    The sensor of claim 11, wherein the free layer further comprises a length  
2 selected for a desired track width.

1           21.     A magnetic storage system, comprising:  
2           a moveable magnetic storage medium for storing data thereon;  
3           an actuator positionable relative to the moveable magnetic storage medium; and  
4           a magnetoresistive sensor, coupled to the actuator, for reading data from the  
5 magnetic recording medium when position to a desired location by the actuator, wherein  
6 the magnetoresistive sensor further comprises:  
7                     a free layer for sensing magnetic fluxuations;  
8                     first hard bias layers abutting the free layer; and  
9                     second hard bias layers, formed over the first hard bias layers  
10           discontiguous from the free layer, the second hard bias layers being anti-parallel  
11           to the first hard bias layers, the first and second hard bias layers providing a net  
12           longitudinal bias on the free layer.

1           22.     The magnetic storage system of claim 21, wherein the first hard bias  
2 layers is formed with a thickness substantially equal to a thickness of the second hard  
3 bias layers.

1           23.     The magnetic storage system of claim 21, wherein the first hard bias  
2 layers is formed with a thickness greater than a thickness of the second hard bias layers.

1           24.     The magnetic storage system of claim 21 further comprising interlayers  
2 disposed between the first and second hard bias layers.

1           25.     The magnetic storage system of claim 21 further comprising a self-pinned  
2 layer, the self-pinned layer having a first end, a second end and central portion, wherein  
3 the central portion is aligned with the free layer and the first hard bias layers are formed  
4 over the first and second ends of the self-pinned layer.

1           26.     The magnetic storage system of claim 25 further comprising a spacer layer  
2 formed over the self-pinned layer and a first and second seed layer formed between the  
3 first and second hard bias layer and the spacer layer.

1           27.     The magnetic storage system of claim 26 further comprising amorphous  
2 layers formed between the spacer and the first and second seed layers, the amorphous  
3 layer stopping epitaxial growth between the self-pinned layer and the first and second  
4 hard bias layers.

1           28.     The magnetic storage system of claim 25 further comprising amorphous  
2 layers formed between the self-pinned layer and the first and second hard bias layers for  
3 stopping epitaxial growth between the self-pinned layer and the first and second hard bias  
4 layers.

1           29.     The magnetic storage system of claim 21 further comprising first and  
2 second leads formed over the first and second hard bias layers.

1           30.    The magnetic storage system of claim 21, wherein the free layer further  
2 comprises a length selected for a desired track width.

1           31.    A self-pinned abutted junction magnetic read sensor, comprising:  
2           first means for sensing magnetic fluxuations;  
3           first bias means abutting the first means on opposite sides of the first means; and  
4           second bias means, formed over the first bias means discontinuous from the first  
5 means for sensing magnetic fluxuations, the second bias means being anti-parallel to the  
6 first bias means, the first and second bias means providing a net longitudinal bias on the  
7 first means for sensing magnetic fluxuations.

1           32.     A magnetic storage system, comprising:  
2           a moveable magnetic storage means for storing data thereon;  
3           an actuator positionable relative to the moveable magnetic storage medium; and  
4           a magnetoresistive sensor, coupled to the actuator, for reading data from the  
5 magnetic recording medium when position to a desired location by the actuator, wherein  
6 the magnetoresistive sensor further comprises:  
7                 first means for sensing magnetic fluxuations;  
8                 first bias means abutting the first means on opposite sides of the first  
9           means; and  
10                second bias means, formed over the first bias means discontinuous from  
11 the first means for sensing magnetic fluxuations, the second bias means being anti-  
12 parallel to the first bias means, the first and second bias means providing a net  
13 longitudinal bias on the first means for sensing magnetic fluxuations.